

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: Kjell Kristoffersen, et al. :
Serial No.: 10/719,431 : Art Unit: 3737
Filed: November 21, 2003 : Examiner: Mehta, Parikha Solanki
For: ULTRASOUND PROBE :
TRANSCEIVER CIRCUITRY AND :
METHOD FOR DECOUPLING A :
RECEIVE SECTION AND TRANSMIT :
SECTION :

APPELLANTS' BRIEF

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The Notice of Appeal in this Application was filed on August 28, 2009. This Appeal Brief is timely because the Appeal Brief is being filed on October 28, 2009, which is within two months of the filing of the Notice of Appeal.

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is General Electric Company, whose address is 1 River Road, Schenectady, New York 12345.

II. RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, judicial proceedings or interferences known to the Appellants which may be related to, directly affect or will be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-27 are pending in the application that is the subject of this Appeal. Claims 1-27 stand rejected and are on appeal.

IV. STATUS OF AMENDMENTS

A Final Office Action was mailed May 28, 2009 and rejected all of the pending claims (i.e., claims 1-27). An Amendment After Final was filed on June 29, 2009, subsequent to the Final Office Action, which was considered by the Examiner. No amendments to the claims were made in the Amendment After Final. In an Advisory Action mailed on July 20, 2009, all claim rejections were maintained. A Notice of Appeal was filed on August 28, 2009.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The following summary does not limit the interpretation of the claims pending in the application that is the subject of this Appeal. Rather, the following summary is provided only to facilitate the Board's understanding of the subject matter of this Appeal. Various embodiments of the invention relate to ultrasound probe transceiver circuitry having signal blocking circuitry.

Independent claim 1 recites transceiver circuitry 600, 700 (pages 20-21, paragraphs 77 and 79 of the specification and Figures 6 and 7) for ultrasound transducer elements E (page 22, paragraph 82 of the specification and Figure 7) that includes a transmit section 702 (page 21, paragraph 79 of the specification and Figure 7) having a transmit section input 704 (page 21, paragraph 79 of the specification and Figure 7) and a transmit section output 706 (page 21, paragraph 79 of the specification and Figure 7). The transceiver circuitry 600, 700 further includes receive signal blocking circuitry 718, C_{coupl} and D2 (page 22, paragraph 80 and page 23 paragraph 84 of the specification and Figure 7) coupled between the transmit section input 704 and the transmit section output 706. The transceiver circuitry 600, 700 further includes a receive section 708 (page 22, paragraph 80 of the specification and Figure 7) having a receive section input 712 (page 22, paragraph 80 of the specification and Figure 7) and a receive section output 710 (page 22, paragraph 80 of the specification and Figure 7). The transceiver circuitry 600, 700 further includes transmit signal blocking circuitry C_{coupl} , D2, back-to-back diode D4 and C2 (page 22, paragraph 80 of the specification and Figure 7) coupled between the receive section input 712 and the receive section output 710 including a coupling capacitor C_{coupl} adapted to decouple the receive section 708 during operation of the transmit section 702.

Independent claim 10 recites an ultrasound probe 100 (pages 5-6, paragraph 33 of the specification and Figure 1) including a transducer array 102 (pages 5-6, paragraph 33 of the specification and Figure 1) comprising array transducer elements 212 (page 17, paragraphs 67 and 68 of the specification and Figure 2) and transceiver circuitry 600, 700 (pages 20-21, paragraphs 77 and 79 of the specification and Figures 6 and 7). The transceiver circuitry 600, 700 includes a transmit section output 706 (page 21, paragraph 79 of the specification and Figure 7) coupled through receive signal blocking circuitry 718, C_{coup} and D2 (page 22, paragraph 80 and page 23 paragraph 84 of the specification and Figure 7) and a coupling capacitor C_{coup} to transmit transducer elements 212 comprising a transmit aperture (page 19, paragraph 73 of the specification and Figure 4). The transceiver circuitry 600, 700 further includes a receive section input 712 (page 22, paragraph 80 of the specification and Figure 7) coupled to a multiplexed transducer element 212 selected from the transmit transducer elements 212 and adapted to be decoupled during operation of the transmit section 702 (page 21, paragraph 79 of the specification and Figure 7), wherein the transmit section output 706 drives the multiplexed transducer element 212 during ultrasound beam transmission and where the receive section input 712 receives a reception signal from the multiplexed transducer element 212 during ultrasound beam reception.

Independent claim 21 recites a method 1800 (page 41, paragraph 137 of the specification and Figure 18) for transmitting and receiving signals through ultrasound transducer elements. The method 1800 includes coupling 1802 (page 41, paragraph 137 of the specification and Figure 18) a transmit pulse through a transmit section input, a transmit section output, and receive signal blocking circuitry coupled between the transmit section input and the transmit

section output. The method 1800 further includes coupling 1804 (page 41, paragraph 137 of the specification and Figure 18) a receive signal through a receive section input, a receive section output, and transmit signal blocking circuitry coupled between the receive section input and the receive section output, wherein the transmit signal blocking circuitry includes a coupling capacitor adapted to decouple the receive section input during operation of the transmit section input and transmit section output.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-27 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Peterson et al. (U.S. Patent 6,050,945), hereafter Peterson, in view of Moore et al. (U.S. Patent 6,511,432), hereafter Moore.

VII. ARGUMENT

Appellants respectfully submit that each claim in the pending application is patentable over the cited references. Appellants traverse the rejections of claims 1-27, request that the rejections be withdrawn, and request that the claims be allowed. In support of these requests, a discussion regarding the patentability of the claimed recitations is set forth below.

According to 35 U.S.C. § 103, patentability is precluded if the claimed subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made. Obviousness is a conclusion of law based upon a number of underlying factual inquiries.

Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966). In KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398 (2007), the Supreme Court rejected a rigid approach to the determination of obviousness. Id. at 415. But, merely pointing out that each element in a claim was known in the prior art may be insufficient to render the claim obvious. Id. at 418 ("[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art."). Some articulated reasoning with rational underpinning must be provided to support an obviousness rejection. Id. ("[R]ejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.").

The rejection of the independent claims will be addressed first followed by the rejection of the dependent claims.

A. Independent Claims 1 and 21 - Rejected under §103 As Unpatentable Over Peterson and Moore

Appellants submit that Peterson in combination with Moore does not disclose each and every element of independent claims 1 and 21. Independent claim 1 recites transceiver circuitry for ultrasound transducer elements including, among other elements “receive signal blocking circuitry coupled between the transmit section input and the transmit section output” and “transmit signal blocking circuitry coupled between the receive section input and the receive section output including a coupling capacitor adapted to decouple the receive section during operation of the transmit section.” Independent claim 21 recites a method for transmitting and receiving signals through ultrasound transducer elements including “coupling a transmit pulse through a transmit section input, a transmit section output, and receive signal blocking circuitry coupled between the transmit section input and the transmit section output” and “coupling a receive signal through a receive section input, a receive section output, and transmit signal blocking circuitry coupled between the receive section input and the receive section output, the transmit signal blocking circuitry including a coupling capacitor adapted to decouple the receive section input during operation of the transmit section input and transmit section output.”

Each of independent claims 1 and 21 includes receive signal blocking circuitry coupled between a transmit section input and a transmit section output, and transmit signal blocking circuitry coupled between a receive section input and a receive section output. Thus, blocking circuitry that, for example, protects probe electronics for transmit and receive (see, e.g., page 20, paragraph 78 of the specification) is provided between the input and the output of the transmit section *and* the input and the output of the receive section.

The Final Office Action at page 2 asserts that Peterson teaches the claimed blocking circuitry between the input and output of each of a transmit section and a receive section. Appellants respectfully disagree.

In the Advisory Action at page 2, the Examiner argues that Peterson shows in Figure 10 sets of back to back diodes between each of the receive and transmit inputs and outputs. Appellants submit that although Peterson discloses sets of back to back diodes at the receive and transmit stages, the back to back diodes are not receive signal blocking circuitry and transmit signal blocking circuitry as required by the claimed invention. Peterson describes that a diode circuit 514, which includes diodes 516 and 518 and a diode bridge 502, which includes diodes 504, 506, 508 and 510 are provided as part of a receiver stage (see, e.g., Peterson, col. 9, lines 7-39). Moreover, diode limiters 524a and 524b having back to back diodes are provided as part of transmit stages 501a and 501b (see, e.g., Peterson, col. 9, lines 3-5). However, these diode limiters 524a and 524b provide non-linear impedance Z3 that is used to correct for noise introduced by the transmit stage (see, e.g., Peterson, col. 5, lines 36-52) and accordingly are not blocking circuitry as claimed. Peterson states that the diode circuit 514 and the diode bridge 502 (i.e., the blocking circuitry) provide the coupling and decoupling operation between the transmitters and receivers, thus operating as blocking circuitry (see, e.g., Peterson, col. 9, lines 21-23). Thus, in contrast to the claimed invention, receive blocking circuitry coupled between the transmit section input and output *and* transmit signal blocking circuitry coupled between the receive section input and output are not provided.

Moreover, there is no reason to modify the diodes of Peterson to include the capacitor of Moore as suggested in the Final Office Action. The Final Office Action, at page 2, asserts that

the modification to include the blocking capacitors of Moore in the receive circuitry of Peterson would have been obvious to "thereby achieve the claimed invention, in view of the teachings of Moore ('532)." There is simply no support for this combination. The Final Office Action, at page 2, states that Moore teaches that the blocking capacitor is effective to shield the receive circuit processing elements from potentially high voltage transmit signals. Appellants submit that the system in Peterson does not need such shielding, and the voltage is already limited by the components therein.

Appellants also submit that the Examiner's conclusory assertion with respect to why the combination is supported by the references is insufficient to support the obviousness rejection. This rational does not satisfy the basic requirements for a proper obviousness rejection. "[R]ejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007). The Examiner fails to provide any articulated reasoning in support of its conclusion. Appellants submit that the Examiner must provide some articulated reasoning other than a teaching in a separate reference. The Examiner provides no reasoning as to why the system of Peterson needs the capacitor of Moore. Appellants submit that such a combination is based on an improper use of the disclosure of the application, namely selecting teachings of various references to simply piece together the claimed invention. The Peterson reference is not concerned with and does not need a capacitor as disclosed in Moore.

For at least the reasons set forth above, the rejection of claims 1 and 21 under 35 U.S.C. §103(a) as being unpatentable over Peterson in view of Moore should be withdrawn.

B. Independent Claim 10 - Rejected under §103 As Unpatentable Over Peterson and Moore

Appellants submit that Peterson in combination with Moore does not disclose each and every element of independent claim 10. Independent claim 10 recites an ultrasound probe including, among other elements “a transmit section output coupled through receive signal blocking circuitry and a coupling capacitor to transmit transducer elements comprising a transmit aperture”, “a receive section input coupled to a multiplexed transducer element selected from the transmit transducer elements and adapted to be decoupled during operation of the transmit section” and “wherein the transmit section output drives the multiplexed transducer element during ultrasound beam transmission and where the receive section input receives a reception signal from the multiplexed transducer element during ultrasound beam reception.” Appellants submit that claim 10 is allowable for at least the reasons discussed in more detail above in connection with claims 1 and 21.

Moreover, Appellants submit that Peterson does not describe a multiplexed transducer element arrangement. In the Advisory Action, at page 2, the Examiner maintains that the transducer element in Peterson “is in fact multiplexed, i.e., it is connected to more than one channel (transmit and receive), and therefore meets the claim.” Appellants submit that under the logic presented by the Examiner, all of transducer elements Peterson can either transmit or receive. In the claimed invention, a multiplexed transducer element is “selected from the transducer elements.” Accordingly, particular transducer elements are selected using the multiplexed arrangement not a particular channel for operation. Accordingly, Appellants submit that claim 10 is also allowable for at least this reason.

Thus, for at least the reasons set forth above, the rejection of claim 10 under 35 U.S.C. §103(a) as being unpatentable over Peterson in view of Moore should be withdrawn.

C. Claims 2-9, 11-20 and 22-27 - Rejected under §103 As Unpatentable Over Peterson and Moore

Claims 2-9, 11-20 and 22-27 depend from claims 1, 10 and 21. Appellants submit that at least because claims 1, 10 and 21 define allowable subject matter, dependent claims 2-9, 11-20 and 22-27 also recite allowable subject matter.

Moreover, claim 19 recites “wherein the multiplexed transducer element is included in a triangular receive aperture comprised of selected array transducer elements.” The Examiner asserts, at page 4 of the Final Office Action, that the transducer element of Peterson is part of a two-dimensional array, which inherently must comprise at least a 2x2 array of four elements, from which three elements can be arbitrarily designated as a triangular receive aperture comprised of selected array transducer elements. There is nothing in Peterson that describes or even suggests such a selection to form a triangular receive aperture. Moreover, there is no support given as why such selection is inherent or would be performed in the system of Peterson. Appellants submit that the required support for this rejection is lacking and there would be no reason to operate Peterson as suggested by the Examiner.

Additionally, with respect to claim 20, the Examiner states, at page 4 of the Final Office Action, that although neither Peterson nor Moore teach that the receive aperture comprises five sections having five, four, three, two and one element(s), respectively, that “it has been previously held that merely changing the size and/or arrangement of known elements is obvious and unpatentable over the prior art” citing to *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA

1955); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966); and *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950).

Appellants submit that the Examiner is merely reciting a supposed *per se* rule of obviousness for rejecting claim 20. The Federal Circuit long ago held that such *per se* rules of obviousness are not acceptable:

The use of *per se* rules... flouts section 103 and the fundamental case law applying it. *Per se* rules that eliminate the need for fact-specific analysis of claims and prior art may be administratively convenient for PTO Examiners and the Board. Indeed, they have been sanctioned by the Board as well. **But reliance on *per se* rules of obviousness is legally incorrect and must cease.** Any such administrative convenience is simply inconsistent with section 103, which, according to Graham and its progeny, entitles an applicant to issuance of an otherwise proper patent unless the PTO establishes that the invention as claimed in the application is obvious over cited prior art, based on the specific comparison of that prior art with claim limitations. **We once again hold today that our precedents do not establish any rules of obviousness, just as those precedents themselves expressly declined to create such rules.** *In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995). (Emphasis Added).

Moreover, the immediate reviewing body, the Board of Patent Appeals & Interferences (BPAI), has since consistently held that *per se* rules like the one provided by the Final Office Action are not acceptable. See, e.g., *Ex parte Gibson* (Appeal 2008-002819, decided September 30, 2009) (restating the above-quoted portion of *In re Ochiai*). Accordingly, such rules are disfavored by the BPAI.¹

¹ Other recent BPAI decisions have strongly discouraged the use of *per se* rules: *Ex parte Pennell* (Appeal 2009-005025, decided September 11, 2009) ("Section 103 requires a fact-intensive comparison of the claimed invention with the prior art rather than the mechanical application of one or another *per se* rule."); *Ex parte Kinstler* (Appeal 2008-6217, decided March 27, 2009) ("The Examiner's reliance on *In re Leshin*, 277 F.2d 197 (CCPA 1960) amounts to little more than a *per se* rule of obviousness. Such *per se* rules are not favored by our reviewing court.").

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In view of the above, Appellants respectfully request that the rejection of all pending claims be withdrawn and the pending claims allowed.

Respectfully Submitted,

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VIII. CLAIMS APPENDIX

1. (rejected) Transceiver circuitry for ultrasound transducer elements, the transceiver circuitry comprising:

a transmit section comprising:

a transmit section input;

a transmit section output; and

receive signal blocking circuitry coupled between the transmit section input and the transmit section output; and

a receive section comprising:

a receive section input;

a receive section output and

transmit signal blocking circuitry coupled between the receive section input and the receive section output including a coupling capacitor adapted to decouple the receive section during operation of the transmit section.

2. (rejected) The transceiver circuitry of claim 1, where the transmit section output is coupled to the receive section input.

3. (rejected) The transceiver circuit of claim 1, where the transmit section input is coupled to the receive section output.

4. (rejected) The transceiver circuitry of claim 1, where at least one of the transmit and receive signal blocking circuitry comprises clamping diodes.

5. (rejected) The transceiver circuitry of claim 1, where the receive signal blocking circuitry comprises clamping diodes coupled to the transmit section output and back-to-back diodes coupled to the transmit section input.

6. (rejected) The transceiver circuitry of claim 1, further comprising back-to-back diodes coupled between multiple transducer elements of the transducer elements, said back-to-back diodes forming a short circuit between said multiple transducer elements during transmit.

7. (rejected) The transceiver circuitry of claim 1, further comprising back-to-back diodes coupled between multiple transducer elements, said back-to-back diodes forming an open circuit between said multiple transducer elements of the ultrasound transducer elements during reception.

8. (rejected) The transceiver circuitry of claim 1, where the transmit signal blocking circuitry comprises clamping diodes coupled to the receive section input and clamping diodes coupled to the receive section output.

9. (rejected) The transceiver circuitry of claim 1, further comprising a voltage step up circuit coupled between the transmit section input and the transmit section output.

10. (rejected) An ultrasound probe comprising:
a transducer array comprising array transducer elements; and
transceiver circuitry comprising:
a transmit section output coupled through receive signal blocking circuitry and a coupling capacitor to transmit transducer elements comprising a transmit aperture;

a receive section input coupled to a multiplexed transducer element selected from the transmit transducer elements and adapted to be decoupled during operation of the transmit section,

wherein the transmit section output drives the multiplexed transducer element during ultrasound beam transmission and where the receive section input receives a reception signal from the multiplexed transducer element during ultrasound beam reception.

11. (rejected) The ultrasound probe of claim 10, where the transceiver circuitry further comprises a transmit section input coupled to a receive section output.

12. (rejected) The ultrasound probe of claim 10, where the receive signal blocking circuitry comprises low level signal blocking circuitry.

13. (rejected) The ultrasound probe of claim 10, where at least one of the transmit and receive signal blocking circuitry comprises clamping diodes.

14. (rejected) The ultrasound probe of claim 10, further comprising transmit signal blocking circuitry coupled to the receive section output.

15. (rejected) The ultrasound probe of claim 10, further comprising back-to-back diodes coupled between multiple transducer elements, said back-to-back diodes forming a short circuit between multiple transducer elements of said array transducer elements during transmit.

16. (rejected) The ultrasound probe of claim 10, further comprising back-to-back diodes coupled between multiple transducer elements, said back-to-back diodes forming an open circuit between multiple transducer elements of said array of transducer elements during reception.

17. (rejected) The ultrasound probe of claim 10, where the transmit aperture comprises a rectangular patch of transmit transducer elements.

18. (rejected) The ultrasound probe of claim 10, where the rectangular patch is a 2x2 patch.

19. (rejected) The ultrasound probe of claim 10, where the multiplexed transducer element is included in a triangular receive aperture comprised of selected array transducer elements.

20. (rejected) The ultrasound probe of claim 10, where a receive aperture comprises a first section of five transducer elements of said array of transducer elements, a second section of four transducer elements of said array of transducer elements, a third section of three transducer elements of said array of transducer elements, a fourth section of two transducer elements of said array of transducer elements, and a fifth section of one transducer element of said array of transducer elements.

21. (rejected) A method for transmitting and receiving signals through ultrasound transducer elements, the method comprising the steps of:

coupling a transmit pulse through a transmit section input, a transmit section output, and receive signal blocking circuitry coupled between the transmit section input and the transmit section output; and

coupling a receive signal through a receive section input, a receive section output, and transmit signal blocking circuitry coupled between the receive section input and the receive section output, the transmit signal blocking circuitry including a coupling capacitor adapted to

decouple the receive section input during operation of the transmit section input and transmit section output.

22. (rejected) The method of claim 21, wherein the transmit section input is coupled to the receive section output.

23. (rejected) The method of claim 21, where the transmit section output is coupled to the receive section input.

24. (rejected) The method of claim 21, where the receive signal blocking circuitry comprises low level signal blocking circuitry.

25. (rejected) The method of claim 21, where at least one of the transmit and receive signal blocking circuitry comprises a clamping diode and an impedance element.

26. (rejected) The method of claim 21, where the receive signal blocking circuitry comprises back-to-back diodes coupled to the transmit section output and clamping diodes coupled to the transmit section input.

27. (rejected) The method of claim 21, where the transmit signal blocking circuitry comprises clamping diodes coupled to the receive section output and back-to-back diodes coupled to the receive section input.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.